MILP : $\min \ \underline{c}_1^T \underline{x} + \underline{c}_2^T \underline{y}$
$s.t. \ A_1 \underline{x} + A_2 \underline{y} \geq \underline{b}$
$\underline{x} \geq \underline{0}$ integer
$\underline{y} \geq 0$

ILP : $\min \ \underline{c}^T \underline{x}$
$s.t. \ A\underline{x} \geq \underline{b}$
$\underline{x} \geq \underline{0}$ integer $\longrightarrow$ if $x_i \in \{0,1\} \ \forall i \Rightarrow$ 0-1 ILP

- Knapsack: $\max \sum_{i=1}^{n} p_i x_i$
  $s.t. \ \sum_{i=1}^{n} a_i x_i \leq b$ — b capacity, a_i weight
  $x_i \in \{0,1\}$

- Set covering: $\min \sum_{j=1}^{n} c_j x_j$ — c_j cost for M_j ($M = \bigcup_j M_j$ is a cover)
  $s.t. \ \sum_{j \in N} a_{ij} x_j \geq 1 \quad \forall i$
  $x_j \in \{0,1\}$

  $= \min \sum_{j=1}^{n} c_j x_j$
  $s.t. \ A\underline{x} \geq \underline{1}$
  $\underline{x} \in \{0,1\}^n$

- Set packing :

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1. Binary choice
   - knapsack
   - set covering
   - set packing
   - set partitioning
2. Association between entities
   - Assignment problem
3. forcing constraints
   - UFL (uncapacitated Facility Locations)
4. Piecewise linear cost function
   - minimization of piecewise linear cost function
5. Exp many constraints
   - ATSP (asym. Traveling Salesman Problem)
6. Disjunctive constraints
   - scheduling
7. linearization